FINAL
MATANUSKA RIVER
DEBRIS REMOVAL ASSESSMENT
PALMER, ALASKA

Prepared for:

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ABBREVIATIONS AND ACRONYMS

ADEC	Alaska Department of Environmental Conservation
Ag	Silver
As	Arsenic
Ba	Barium
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
Cd	Cadmium
Cr	Chromium
DRO	Diesel-Range Organics
GRO	Gasoline-Range Organics
Hg	Mercury
MCL	Maximum Contaminant Level
OASIS	Oasis Environmental, Inc.
PAH	Polynuclear aromatic hydrocarbon
Pb	Lead
PCB	Polychlorinated biphenyl
PID	Photoionization Detector
QA/QC	Quality Assurance/Quality Control
RRO	Residual-Range Organics
TAH	Total aromatic hydrocarbons (BTEX)
TAqH	Total aqueous hydrocarbons (TAH + PAH)
Se	Selenium
VOC	Volatile Organic Compounds

UNITS OF MEASURE

CFM	Cubic feet per minute
µg/Kg	Micrograms Analyte per Kilogram of Sample
µg/L	Micrograms Analyte per Liter of Sample
mg/Kg	Milligrams Analyte per Kilogram of Sample
mg/L	Milligrams Analyte per Liter of Sample
psi	pounds per square inch

1.0 INTRODUCTION

This report presents the results of our debris removal assessment for a debris disposal area located along a stretch of the Matanuska River just north of Eagle Avenue in Palmer, Alaska. The general site location and surrounding area are shown on Figure 1.

In May 2004 a site assessment was performed to determine the extent and quantity of debris and evaluate any potential impacts to the Matanuska River. The site assessment results are presented in *Final Report Matanuska River Debris Site Assessment, Palmer, Alaska* (OASIS, 2004b).

The second objective of the project is to develop a debris removal and disposal plan that addresses permits needed, cost estimates, site logistics, and site safety concerns (from contents of debris pile such as contaminants and from the actual debris removal process). However based on the site assessment results and other considerations this objective was modified slightly to include evaluating the feasibility of a debris removal action particularly as compared to the no action alternative. This document was prepared to address this second objective.

This work was performed under Contract No. 18-5006-12 for the Alaska Department of Environmental Conservation (ADEC). OASIS Environmental, Inc. (OASIS) performed this work in accordance with our April 6, 2004, proposal and May 18, 2004, ADEC approved work plan and quality assurance project plan (OASIS, 2004a).

1.1 PROJECT DESCRIPTION

The purpose of this debris removal assessment is to investigate and evaluate the following items:

1. Conduct a site visit that includes representatives from the Alaska Department of Natural Resources (ADNR), Hydrologic Survey Division; Palmer Soil and Water Conservation District; ADEC; and OASIS Environmental to evaluate potential debris removal impacts on bank stability.

2. Conduct a review of available documentation on river stabilization practices for the Matanuska River. In particular evaluating the efficacy of using vehicles, train cars, etc. for bank stabilization.

3. Assemble a list of permits needed to perform a debris removal action.

4. Prepare a cost estimate to perform a debris removal effort.

5. Evaluate the advantages and disadvantages of performing a debris removal action in comparison with the no action alternative.

2.0 PROJECT BACKGROUND

There is an unpermitted active dump located on and in the Matanuska River just north of Eagle Avenue in Palmer, Alaska. The disposal area is accessed from the old railroad bed off of Eagle Avenue that is now part of a hiking trail system. Debris is deposited along a stretch of the Matanuska River approximately ¼ to ½ mile upstream of Eagle Avenue and is mainly concentrated in an area approximately ¼ mile from Eagle Avenue. Visible contents of the dump at the time ADEC inspected it on June 14, 2002, included railroad cars, vehicles, household refuse, fuel cans, possible 55-gallon drums with unknown contents, scrap metal, and other miscellaneous debris. River channels run through and next to the dump at all times of the year. Visible sheens have also been observed in the river. This open dump is within the Drinking Water Protection Area for a minimum of three public water systems. These public water systems include Mountain View Estates (PWSID 226509.001), Palmer Well No. 4 (PWSID 226020.00, and the Palmer Golf Course (PWSID 227482.001).

The ADEC has placed this segment of the Matanuska River on the 2002 Section 303(d) list as an impaired water body and it is in Category 5 on Alaska's 2002 Integrated Water Quality Monitoring and Assessment Report, for non-attainment of the Residues standard for debris as provided for in the Water Quality Standards for Fresh Water Uses [18 AAC 70.020(b)].

Figures 2 and 3 are aerial photos that depict general site features at various times. Figure 2 is a May 1989 aerial photo that shows evidence of debris accumulations within the debris disposal area. Figure 3 is a May 2000 aerial photo of the same area.

2.1 PROPERTY OWNERSHIP

The Alaska Railroad Corporation (ARRC) is the landowner of the former Palmer to Sutton Branchline that parallels the Matanuska River and passes by the debris disposal area at approximately ARRC Milepost A-8.3 of the Palmer Branchline. There is an existing Public Use Trail Permit, ARRC Contract No. 8511, in the vicinity of the debris disposal area with the City of Palmer, the State of Alaska, Department of Natural Resources (DNR), and the Matanuska-Susitna Borough (Borough). The City of Palmer’s control ends approximately 425 feet north of the centerline of East Eagle Avenue; at which point DNR and the Borough areas of control begin.

The main debris disposal area is located approximately 1,200 feet north of Eagle Avenue and is therefore in the Public Use Trail Permit region that is controlled by DNR and the Borough.

2.2 SUMMARY OF SITE ASSESSMENT RESULTS

A site assessment was performed on May 26 and 27, 2004 to visibly document the debris disposal area, estimate the volume of debris present, and evaluate whether any contaminant impacts to the Matanuska River or environment have occurred because of the debris dumping. A brief summary of the findings are presented below.

The debris disposal area is located along the old Palmer to Sutton railroad line where it parallels the Matanuska River just north of Palmer. Debris was observed to be scattered along the old railroad line for approximately one-half mile but is mainly concentrated in one area where the old railroad line meets up with the Matanuska River as shown on Figure 1.

This main debris disposal area was found to be comprised of primarily metal debris consisting of old railroad cars, automobile bodies, empty drums, metal lath cuttings, miscellaneous appliances (washing machines, refrigerators, etc.), and other metal debris. The main debris disposal area as shown on Figure 6 of the Site Assessment Report (OASIS, 2004b) is estimated to be approximately 20,000 square feet or just less than one-half acre in size, of which approximately half is heavily covered with debris. Assuming the size of the debris pile is 10,000 square feet and is roughly two to four feet in thickness the volume of debris is estimated to be 20,000 to 40,000 cubic feet or approximately 750 to 1,500 cubic yards. Using an estimated density of 20 pounds per cubic foot the weight of the debris is estimated at 200 to 400 tons of debris. Assuming that each of the railcar frames weight approximately 2 tons and the automobile frames weight approximately 1 ton, we estimate that the quantity of debris below the ordinary high water level to be at most ten to twenty tons. These estimates do not include the additional scattered railroad car debris that was noted upstream of the main debris pile.

Surface water, sediment, and soil samples collected during the site assessment show no indications of contaminant impacts from the debris to these media. All surface water sample results for VOC, PAH, TAH, TAqH, pesticides and PCB, and RCRA metals analyses were either below the laboratory reporting limit or their applicable ADEC cleanup level. All sediment sample results for VOC, GRO, DRO, RRO, and pesticides and PCBs are below their laboratory reporting limits. Arsenic was present in all three sediment samples at concentrations above the NOAA Screening Quick Reference Tables (SQuiRTs) freshwater sediment threshold effects level of 5.9 mg/Kg (NOAA, 1999). All other RCRA metals results are below their NOAA freshwater sediment screening levels.

All soil sample results for VOC, GRO, DRO, RRO, and pesticides and PCB analyses are below the laboratory reporting limit with the exception of the soil sample taken at location MD-07. This soil sample (04MD-007SO) contained 40.1 VJ mg/kg of DRO, 257 VJ mg/kg of RRO, and 0.00121 mg/kg of trichlorofloromethane. All of these results are below their applicable ADEC cleanup levels. Several RCRA metals (As, Ba, Cd, Cr, Pb, and Se) were detected in the soil samples at concentrations below their applicable ADEC cleanup levels with the exception of arsenic. Arsenic was present in all of the soil samples at concentrations above the ADEC cleanup level of 2.0 mg/Kg.

The United States Geological Survey (USGS) performed streambed sediment studies to determine the naturally occurring concentrations of arsenic in the Cook Inlet Basin. Streambed-sediment samples have been collected in the Cook Inlet Basin as part of the National Uranium Resource Evaluation (NURE) Hydrogeochemical and Streambed Sediment Reconnaissance program as well as for the National Water-Quality Assessment (NAWQA) program and studies with the National Park Service. NURE samples had arsenic concentrations from less than 5 to 184 mg/Kg, in 94 samples collected in 1977 (USGS, 2001). NAWQA samples and samples collected for the National Park Service had arsenic concentrations from 1.7 to 88 mg/Kg in samples collected from 47 sites during 1998 to 2000 (USGS, 2001). The arsenic concentrations in the soil and sediment samples collected from the dump site are all within the range of these studies; therefore, it appears likely that the arsenic is naturally occurring in the soil/sediment and does not represent contamination from the debris disposal area.

Several pieces of material consisting primarily of portions of railroad cars were observed to be within the Matanuska River water column. This represents a violation of the Water Quality Standards for residues [18 AAC 70.020(b)]. However, no indication of surface water sheening or other visible evidence of degradation of the water quality was observed during the site assessment. Also no visible signs (e.g., surface staining, discoloration, etc.) of potential contamination to the environment from the material were observed. Car batteries and engines had been removed from the several automobiles that were inspected.

In conclusion, while the debris disposal area does not appear to represent any type of potential contamination threat to the environment, the material in the river is still a violation of the state water quality standards and the ARRC will need to obtain the appropriate ADEC permits for in-water structures to allow the material to remain in the river. The main debris disposal pile also represents a public safety hazard particularly for children. During our site assessment two groups of children came out to the debris disposal area to investigate and horse around. Similarly on a subsequent visit to the site we observed graffiti on pieces of debris that had not previously been present. Therefore, the debris disposal area does represent a potentially dangerous attractive public hazard that will require some active measures be taken to mitigate this hazard.

2.3 REVIEW OF MATANUSKA RIVER EROSION STUDIES

The following list of documents on Matanuska River erosion and bank stabilization were reviewed for this report.

- *Channel Shifting and Bank Erosion of the Matanuska River near Palmer* (Long, 1998).
- *Matanuska River Watershed, Review of Resources* (Palmer Soil and Water Conservation District and Alaska Division of Mining and Water Management).
- *Matanuska River Erosion Control Recommendations* (PN&D, 1992).
- *Hydrologic Data for the Matanuska River Watershed, Southcentral Alaska.* (Maurer, 1998).
- *Background Studies for Expedited Reconnaissance Study of Matanuska River Erosion.* (USACE, 2003).

Important aspects and characteristics of glacially fed rivers such as the Matanuska River are summarized here. Additional information and details are found in the above references. The Matanuska River is a classic example of a large, braided, glacial outwash stream. The large sediment load and stream flow variations lead to channel movement as the stream seeks the easiest flow path depending on energy of the stream flow and size of depositional materials thereby causing the braided channel patterns. Glacial river flow patterns and timing differ from non-glacial streams. Hot summer days with clear skies and no precipitation cause glaciers to melt and the river to increase flow; in strong contrast to non-glacial streams where flow subsides during hot dry conditions.

Mean monthly flows for the Matanuska River are lowest during March (466 cubic feet per second [cfs]) and highest during July 12,840 cfs. The USGS estimated 100 year flood discharge is estimated at 50,500 cfs. However, during August 10 of 1971 heavy rains fell on tributary basins of the Matanuska River leading to a natural dam failure on Granite Creek and a maximum flood discharge of 82,100 cfs. The Matanuska River transports approximately five million (5,000,000) tons of sediment per year. The sand and gravel fraction of that load is about 397,000 tons (257,000 cubic yards) of material (Long, 1998).

Four general categories for erosion control have been proposed by the USGS for use on the Matanuska River (USGS, 2003). They include (1) flow deflecting structures, (2) bank armoring, (3) gravel extraction, and (4) non-structural measures (e.g., moving homes and infrastructure out of harms way). Bank armoring is the most common method of protecting banks from erosion. Depending on conditions, bank armoring may be accomplished using vegetation (biotechnical), rock (riprap), rock filled gabions or other manufactured revetments such as articulated concrete mattresses. Because of hydraulic conditions, including velocities on the order of 10 feet per second and sheer stresses exceeding 2 pounds per square foot, biotechnical approaches have not been used on the Matanuska River (USGS, 2003).

None of the aforementioned reports discussed the efficacy of using car bodies or train cars for bank stabilization purposes. Overall the primary factors that would make car bodies and to a lesser extent train cars less desirable and unsuitable for bank stabilization include a large surface area to low weight ratio and overall size of the objects. The large surface area to low weight ratio means the material is more easily carried away by the river forces as compared to large rocks or riprap type materials. The large size of these objects also means it would be more difficult to accurately place and arrange them. This is likely to leave potential erosion gaps between the objects whereby the bank material behind them could still be eroded. Finally the use of automobiles and train cars as riprap materials would detract from the scenic quality of the area.

3.0 SITE VISIT

On July 16, 2004, personnel from the Alaska Department of Natural Resources (ADNR), Palmer Soil and Water Conservation District, ADEC, and OASIS Environmental conducted a site reconnaissance of the debris disposal site and adjoining areas along the Matanuska River. Participating in the site visit were Mark Inghram and Mary Maurer from ADNR - Alaska Hyrologic Survey; Chris Nahorney from ADNR South Central Lands Section; Kent-Patrick Riley and Laura Eldred from ADEC; Bill Long from Palmer Soil and Water Conservation District; and Tim McDougall from OASIS Environmental.

The primary purpose of this site reconnaissance was to make a joint assessment of the disposal site to evaluate whether on not the abandoned railroad cars are providing bank stabilization along the Matanuska River. Secondarily the purpose of the site visit was to make a joint assessment of the disposal site to determine what remedial action is warranted. Photographic documentation of the site visit is provided in Appendix A.

3.1 FINDINGS

On our arrival at the debris disposal site it was observed that active dumping is still occurring at the site as evidence of recent disposal of tree cuttings (Photo Page 1) and tire tracks on the hiking trail (Photo Page 8) were observed.

A letter summarizing the team's assessment of the debris disposal site is provided in Appendix B. The key findings of which are summarized below:

- It is the team's assessment that based on the haphazard and disorganized arrangement of the railcar and other railroad debris that little attempt was made to place the disposed equipment in a manner to maximize the erosion reduction potential. However, some of the railcar debris does appear by a fortuitous nature to offer effective protection against active erosion by the Matanuska River (Appendix A – Photo Page 2).
- Although uncertain, it appears that most of the disposed debris is on the Alaska Railroad Corporation (ARRC) property. The ARRC has a two hundred foot wide right-of-way along the former Palmer to Sutton Branchline.
- Some of the railroad debris has slid down to the point where it is below the ordinary high water mark, indicating that it is on State owned lands.
- At the present time the disposal area embankment is well vegetated and appears to be stable.
- Removal of any of the large and heavy railroad equipment would by necessity result in the near destruction of the vegetative cover that is essential to erosion control. The only logical conclusion is that from a bank stability viewpoint, protecting not only the disposal reach, but also the reach adjacent to the residential subdivision immediately downstream, that the railroad equipment now on the bank remains as is. Removal is likely to cause exposure of a potentially easily erodible bank to the sediment moving potential of the Matanuska River.

- The automobile and other smaller pieces of debris from the main debris disposal pile could be removed with little effect to the bank stability. Removal of only the smaller items could also be performed more cost effectively due to the reduction in the quantity of debris.

On completing the debris disposal site visit the team moved on to observe an area of active erosion along the Matanuska River in the Bodenburg Butte area. The first place we stopped was at a site where rock finger dikes were installed in 1992 to prevent further bank erosion caused by the Matanuska River (Appendix A – Photo Page 9). This was the location of a recent episodic erosion event where homes fell into the river as a result of the bank erosion. The rock finger dikes appeared to be effective at preventing further bank erosion between them. However, just downstream of this location active bank erosion was occurring due to fairly high stream flows (13,800 cubic feet per second on July 16) in the Matanuska River caused by the warm summer temperatures and glacier melting. Over 80 feet of the bank had reportedly been eroded since July 11 (5 days) and the local access road was currently being eroded away (Appendix A – Photo Pages 10 through 12).

4.0 FEASIBILITY OF DEBRIS REMOVAL

The overall goals for a debris removal action must be balanced against potential environmental impacts and safety concerns created by conducting the removal action. The primary goal of the removal action from ADEC perspective is protection of water quality in the Matanuska River. Other benefits of the debris removal action include esthetic improvements of the landscape and mitigation or elimination of public safety hazards.

In considering potential alternatives to eliminate or reduce the negative impacts created by the debris pile we believe there are only two viable options. The first is the no action alternative which is to leave the debris remaining where it is. The second is to remove the debris or a portion of the debris and send it to a permitted landfill site or a metal recycling facility. A third option debris burial was eliminated from consideration due to the unsuitable site conditions (i.e., steep bluff that is easily eroded and adjacent river).

A discussion of the debris removal process, benefits of the removal action, potential impacts to the environment, and cost estimate for a removal action is provided in this section.

4.1 DEBRIS REMOVAL

The debris removal effort will require manpower, equipment, and materials capable of lifting heavy pieces of metal from the bottom of the bluff and placing them on a truck for transportation to a recycling or disposal facility. A crane or similar piece of equipment would be used to lift the debris material and transport it to the top of the bluff for placement on a flatbed trailer or truck. We assume that rail cars and other large pieces of metal debris will be cut into smaller chunks to reduce the size of equipment necessary to move such large and heavy items. This should also reduce the safety hazards associated with moving bulky heavy items.

It is likely that the debris pile would need to be removed starting near the top of the bluff and working down toward the bottom. One reason for this is the instability of the debris pile where a top down approach would help reduce the potential from debris higher up the bluff slipping down on a lower work area. Secondly, it is possible that a crane with a smaller boom could then be used because the debris could be dragged part way up the bluff before being lifted into the air.

4.1.1 Quantity of Debris

As reported in the Site Assessment Report the total quantity of debris within the main disposal are is estimated at 200 to 400 tons of debris (OASIS, 2004b). This estimate does not include the various scattered pieces of railroad car debris located within the wooded areas of the bluff upstream of the main debris disposal site. However, only a small fraction of this quantity is actually on State lands that are defined as those below the ordinary high water mark. The quantity of debris that is below the ordinary high water line is rather small (less than a 5 foot width along the length of the main debris disposal area). For instance during the July 16, 2004, site visit when the Matanuska River daily mean stream flow was reported at 13,800 cubic feet per second (cfs) the only debris below the high water level was several railcars and a couple of automobile bodies. This flow event is considered representative of the ordinary high water level mark since the maximum daily mean stream flow for the Matanuska River, which occurs on July 12, is 13,890 cfs for 31 years of record. Assuming that each of the railcar frames weight approximately two tons and the automobile frames weight one ton, we estimate that the quantity of material below the ordinary high water level to be at most ten to twenty tons. Therefore, the quantity of material on State lands that the ADEC has jurisdiction over is less than ten percent of the material within the main debris disposal area.

We believe that if ADEC chose to remove the material on State lands they would be required to remove additional debris outside these limits due to the instability of the debris pile and high probability that debris higher up the bluff would topple or slide downwards towards the river as any debris is removed from this lower area. This would likely result in removal of all the debris or require the placement of structural devices to hold the debris in place.

4.1.2 Site Safety Concerns

Working with heavy metal debris on a steep slope inherently includes a number of safety hazards. Some of the safety hazards that need to be considered include instability of the debris pile, lifting and moving of large heavy objects, heavy objects being overhead, and the awkwardness of working on a steep and slippery surface.

4.1.3 Implementability

The location of this debris disposal site increases the difficulty and cost of the debris removal effort. All of the railroad debris outside of the main debris disposal site has been overgrown with trees and other vegetative cover. Tree removal would be required before any of this debris could be removed (see Photo Pages 5 through 7 in Appendix A). Additionally much of the debris near the base of the bluff is buried or partially buried and excavation of this material would be required for debris removal. As discussed below both of these efforts would also increase the erodibility of the bluff material.

4.2 ENVIRONMENTAL IMPACTS FROM REMOVAL EFFORTS

Implementation of the debris removal effort includes consideration of several factors regarding potential negative impacts to the environment as well as controls that must be implemented to mitigate environmental impacts during the removal phase.

4.2.1 Site Access

Transporting heavy equipment to the site would necessitate creating an access route to the debris disposal site. The two most likely access routes would either enter off of Eagle Avenue and follow along the hiking trail to the site (Figure 1) or come up the river from the Old Glenn Highway Bridge crossing near Palmer. The river access route was eliminated from consideration due to the constantly changing nature of a braided stream and size of barge needed to carry equipment and supplies to do debris removal.

The Eagle Avenue and hiking trail access route would require clearing trees along the hiking trail and further widening of the trail to permit driving heavy equipment to the site. At a minimum this would cause temporary degradation to the aesthetic beauty of the landscape along the hiking trail and potentially the adjoining subdivision. Additional expense would also be incurred to plant trees and restore the hiking trail to its pre-disturbance conditions.

4.2.2 Disturbance to Native Vegetation

At the present time the disposal embankment is well vegetated and appears very stable. Most of the railroad debris was likely dumped here around 1969 when the Palmer to Sutton rail line was abandoned. Subsequent to that time trees have grown up around and through much of the railcar debris (Photo Page 7) especially that outside of the main debris disposal area. Removal of any of the railroad debris outside of the main disposal area would require clear cutting of these trees to allow access for debris removal, and thus resulting in the destruction of this vegetative cover that is essential to bank stability and erosion control.

Although less certain it is probable that debris removal efforts at the main disposal area would be hampered by the nearby trees and may require selective tree removal for operational efficiency (e.g., movement of the crane boom). Secondly, to reduce costs and increase availability of equipment selection it is recommended that a smaller crane with a 50 to 60 foot boom reach be used for the removal action. A crane of this size would not be able to reach out to all the debris particularly that closer to the river. This will require that the debris be dragged part way up the bluff before being lifted into the air; thereby destroying any vegetative cover along the drag path. In any case the debris removal effort will result in disturbance of the vegetative cover on the embankment and therefore require erosion control and revegetation efforts.

A comprehensive erosion control and revegetation plan should be required and approved before starting a debris removal effort. At a minimum the plan should include the following elements.

- Restrict tree cutting to only that required to effectively complete the debris removal effort.
- Silt fencing or the equivalent to retain as much soil along the embankment as possible.
- Revegetation of all disturbed areas on the embankment. The steep slope will likely require staking of a jute mesh or other suitable matting material to promote good vegetative growth.
- Planting of shrubs and trees to promote growth of larger vegetation and reestablishment of trees on the embankment.
- Required watering and maintenance of the revegetative effort for one to two years.

4.2.3 Erosion of River Bank

Characteristic of any braided channel morphology is the constant erosion and deposition of alluvial material. The evidence of this continual cycle of movement and redeposition is evident throughout the Matanuska River valley. The Matanuska River is a large dynamic system that within recent geological time has moved all over the floodplain and is only constrained by structural limits imposed by bedrock outcroppings. The inherent instability of the Matanuska River system makes any prediction of its expected behavior nearly impossible (Palmer Soil and Water Conservation District – *Matanuska River Watershed Review of Resources*).

Recent episodic events of erosion have occurred in various locations along the Matanuska River. One of the most notable events that occurred in 1991 and again this year is at the Circle View Estates subdivision near Bodenburg Butte. Dramatic photos of houses falling into the river resulting from bank erosion in this area have been shown on television and in newspapers. Photo pages 10 through 12 in Appendix A also show recent evidence of the Matanuska River erosion potential, where over 80 feet of bank had eroded in six days. The destructive potential resulting from the erosion potential of the Matanuska River is certainly demonstrated by these events.

Based on the July 16, 2004 site visit two hydrologists from the ADNR Alaska Hydrologic Survey concluded that removal of the entire debris pile, in particular the rail car debris near the river's edge, could result in exposure of the bank to the eroding potential of the Matanuska River (Appendix B). Furthermore this could potentially lead to eroding of the bank and bluff at the residential subdivision immediately downstream of the debris disposal site.

Due to the site location and long steep embankment the variety of potential bank stabilization methods are limited and very expensive. One possible bank stabilization technique would be to place large rocks as bank armoring along the rivers edge. The stretch of bank armoring that could be accomplished would at most be the length of the debris removal area and probably only a subset thereof, due to the difficulty of getting the crane boom to reach all bank locations.

4.2.4 Plans and Permitting

Numerous permits and plans will need to be completed prior to performing a debris removal effort. Table 4-1 provides a list of the potentially required permits. Other planning items that may be required include bid construction plans and specifications, erosion control and slope stabilization (revegetation) plan, and a site health and safety plan.

Table 4-1 List of Permits Potentially Required for Debris Removal Action

Permit or Approval	Law, Regulation, or Other Requirement	Agency	Relevance
Section 404 Wetlands Dredge or Fill Permit; Section 10: Work in Navigable Waters Permit	33 USC Chapter 26, Section 1344 33 CFR 320-330, Rivers and Harbors Act 33 USC 403 33 CFR 320-330	Department of the Army Corps of Engineers (Corps)	Required for dredge/fill activity below mean high water of rivers and streams. A Nationwide Permit No. 38, "Cleanup of Hazardous and Toxic Waste" or other Nationwide Permits may be applicable and reduce the complexity and time requirements for permitting.
Consistency Review of Coastal Project Plans	Alaska Coastal Management Program (ACMP) AS 44.19.155 AS 46.40 6 AAC 85 6 AAC 50 16 USC 1451, 1456	Alaska Department of Natural Resources (ADNR) Office of Project Management and Permitting (OPMP)	Required as part of the Clean Water Act permit.
Permit Review	Section 106 of the National Historic Preservation Act of 1966 (NHPA) 36 CFR Part 800	State Historic Preservation Office (SHPO).	Required as part of the Clean Water Act permit. May be covered by simple notification of State Historic Preservation Office (SHPO). Requires Federal agencies to take into account the effects of their undertakings on historic properties.
Permit Review	Magnuson-Stevens Fishery Conservation and Management Act	US Department of Commerce National Marine Fisheries Service (NMFS)	Requited as part of the Clean Water Act permit.
Land Use Permit	AS 38.05 11 AAC 96 11 AAC 58.210	Alaska Department of Natural Resources (ADNR) Division of Mining Land and Water	Potential requirement for access to site if on State lands.
Fish Habitat Permits	AS 41.14.870 AS 41.14.840 Title 41 Permit	Alaska Department of Natural Resources (ADNR) Office of Habitat Management and Permitting (OHMP)	Required for activity within anadromous fish stream. (Permit to conduct activities affecting anadromous fish streams and provide for the efficient passage of fish in all fish streams)

Permit or Approval	**Law, Regulation, or Other Requirement**	**Agency**	**Relevance**
Construction Contractor License	AS 08.18.011 - .171 12 AAC 21	Alaska Department of Revenue	General requirement for contractors working on project.
Industrial Use Highway Permit	AS 19.05 AS 19.40 17 AAC 30.010-.070	Alaska Department of Transportation and Public Facilities (ADOTPF)	Required for transport of oversize vehicles such as cranes on state highway.
OSHA regulations	AS 18.60.180; 8 AAC 80	Department of Labor Standards and Safety	General requirement for contractors working on project.
Alaska Railroad Corporation Permit and Construction Agreement	Landowner policy	Alaska Railroad Corporation	Required for access on or across ARRC lease lands.
Code of Ordinances: Floodplain Permit and Excavation/Construction Permit for Public Roads.	Mat-Su Borough Code of Ordinances	Mat-Su Borough	Potential requirements should be reviewed.

4.3 ESTIMATED COSTS OF A DEBRIS REMOVAL EFFORT

The estimated costs of performing a debris removal effort are discussed in this section. This cost estimate assumes that a crane or similar piece of equipment would be used to lift the debris material and transport it to the top of the bluff for placement on a flatbed trailer for hauling to a metal recycling facility. A detailed cost analysis and narrative is included in Appendix C.

Another alternative for debris removal would be to use a wench to drag the debris up the slope to the top of the embankment. This alternative would eliminate the cost of a crane but would likely result in increased slope stabilization and revegetation costs. No cost estimate was prepare for this alternative.

4.3.1 Assumptions

The primary assumptions used in preparing this cost estimate are discussed here. Additional assumptions and costing details are provided in Appendix C. First it was assumed that none of the railcar debris would be removed from the site. This includes all the railcar debris outside the main debris disposal area and all railcar materials that are near the river within the main debris disposal area. Based on this assumption the estimated total quantity of debris for removal was reduced to 100 to 200 tons. Because only limited debris removal would be performed along the river bank it was also assumed that no bank stabilization efforts would be required.

It was assumed that a cable crane with a 50 to 60 foot boom reach would be suitable for the debris removal effort.

4.3.2 Labor and Equipment

Labor and equipment required for the debris removal effort includes the following items.

- Cable crane with 50 to 60 foot boom with operator and two labors to attach debris
- Dozer to construct site access route
- Excavator to crush debris and load it on truck
- Truck(s) with flatbed trailer to haul debris
- Laborers to cut trees for site access, cut large pieces of debris, load debris, and revegetation tasks
- Hydro-seeding/mulching equipment and water truck

4.4 BENEFICAL FACTORS OF DEBRIS REMOVAL

Other than the removal of “residues” from a State water body and esthetic benefits there appears to be little benefit from the ADEC jurisdictional viewpoint with regard to removal of the debris pile.

4.4.1 Benefits outside ADEC Jurisdiction

While outside the responsibility and jurisdictional authority of the ADEC, debris removal efforts would provide additional benefits.

The debris in particular the main debris pile represents a public safety hazard. The instability of piled debris could trap or crush someone that is crawling around or over the debris. Sharp metal edges are also present all over the debris pile. The public hazard represented by the debris pile is further compounded by the fact that it is located on a steep and slippery slope. During our site visits we observed several occasions where children were playing and walking around in the debris pile. Graffiti was also observed at the debris pile on the July 16 site visit (Appendix A – Photo Page 5). Removal of the debris pile would eliminate this public safety hazard.

Once a debris pile is created it tends to attract the disposal of additional debris. During our July 16 site visit we observed tree cuttings that had been recently placed at the top of the debris pile. Removal of the debris pile would eliminate, and at a minimum reduce, the desire to dump additional debris at this site.

5.0 CONCLUSIONS

A comparative analysis of the advantages and disadvantages of ADEC performing a debris removal action against the no action alternative was performed and shows that the no action alternative is clearly the preferred alternative. The primary factors leading to this conclusion are summarized below:

- Any debris removal effort would by necessity result in a disturbance of the vegetative cover that is essential to erosion control on this steeply sloping embankment. Revegetation of this site would be rather expensive due to the steep slope and limited site access.
- Debris removal on State lands (below the ordinary high water mark) is likely to cause exposure of a potentially easily erodible bank to the sediment moving potential of the Matanuska River. Not only would debris removal potentially result in bank erosion along the disposal reach, it could also have adverse effects on the reach adjacent to the residential subdivision immediately downstream of the disposal site. Due to the site location and difficult accessibility of the stream bank, any stream bank stabilization efforts would also be very difficult and expensive to construct.
- The estimated cost for a limited debris removal effort is in the range of $231,000 to $495,000. This cost estimate assumes that none of the railcar debris would be removed and that no bank stabilizations efforts would be required along the Matanuska River.
- The debris disposal area does not appear to represent any type of potential contamination threat to the environment, however the material in the river is still a violation of the state water quality standards and the ARRC will need to obtain the appropriate ADEC permits for in-water structures to allow the material to remain in the river.

While outside the ADEC's responsibility and authority, we do provide the following recommendations to prevent further open dumping at this site and to reduce the public safety hazardous presented by this debris area.

- Install bollards or another suitable barrier to prevent vehicular access to the dump site by the hiking trail at the Eagle Avenue access point and any other points of public access.
- The debris site presents a potential public hazard for children and steps should be taken to minimize the potential for harm. Debris removal is the preferred alternative for minimizing risk but may be cost prohibitive. Other alternatives may include installation of a fence around the debris area to restrict public access.

6.0 REFERENCES

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FIGURES

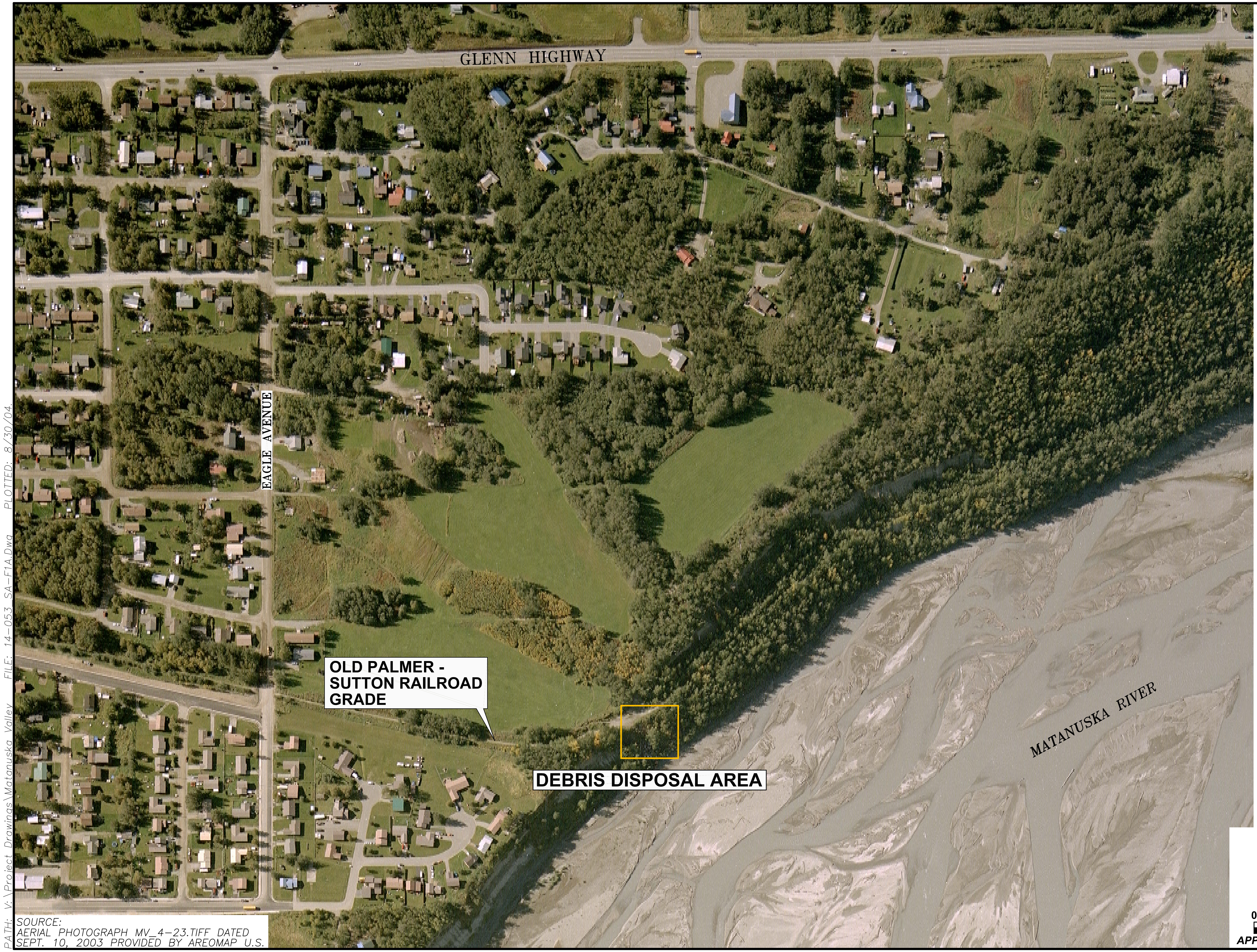


FIGURE 1

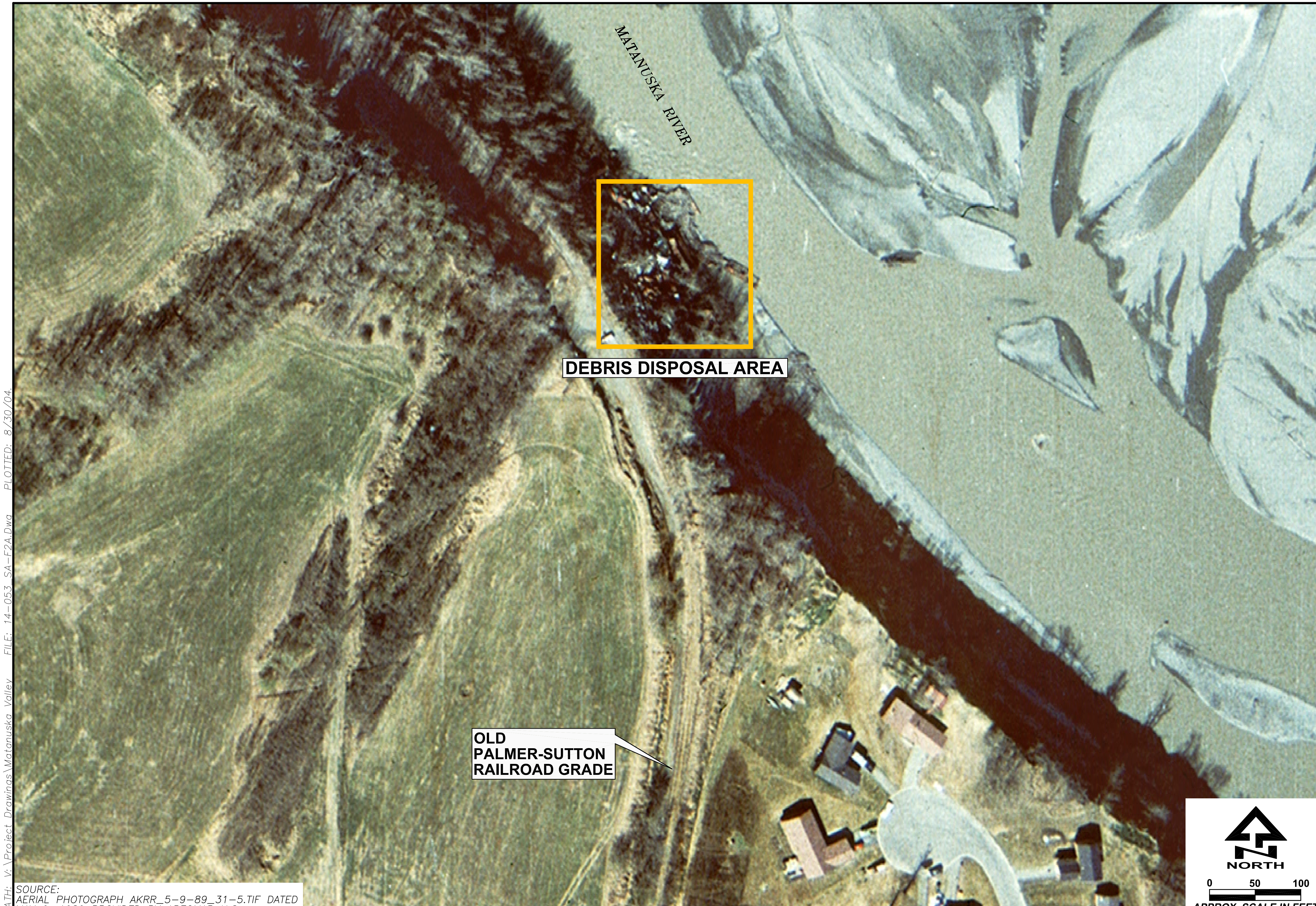
SITE LOCATION MAP
SEPTEMBER 10, 2003 PHOTOGRAPH

MATANUSKA RIVER DEBRIS REMOVAL ASSESSMENT
Palmer, Alaska

oasis ENVIRONMENTAL
807 G STREET, SUITE #250
ANCHORAGE, ALASKA 99501

DATE AUGUST 2004
CHKD T.M.
DRAWN C.E.H.
PROJ. NO 14-053

PATH: V:\Project Drawings\Matanuska Valley FILE: 14-053 SA-F1A.Dwg PLOTTED: 8/30/04.



SOURCE:
AERIAL PHOTOGRAPH AKRR_5-9-89_31-5.TIF DATED MAY 9, 1989 PROVIDED BY AREOMAP U.S.

FIGURE 2

SITE MAP
MAY 9, 1989 PHOTOGRAPH

MATANUSKA RIVER DEBRIS REMOVAL ASSESSMENT
Palmer, Alaska

oasis ENVIRONMENTAL
807 G STREET, SUITE #250
ANCHORAGE, ALASKA 99501

DATE	AUGUST 2004
CHKD	T.M.
DRAWN	C.E.H.
PROJ. NO	14-053

PATH: V:\Project Drawings\Matanuska Valley FILE: 14-053 SA-F2A.Dwg PLOTTED: 8/30/04.

FIGURE 3

SITE MAP
MAY 10, 2000 PHOTOGRAPH

MATANUSKA RIVER DEBRIS REMOVAL ASSESSMENT
Palmer, Alaska

ENVIRONMENTAL
807 G STREET, SUITE #250
ANCHORAGE, ALASKA 99501

DATE AUGUST 2004
CHKD T.M.
DRAWN C.E.H.
PROJ. NO 14-053

PATH: Y:\Project Drawings\Matanuska Valley FILE: 14-053 SA-F4A.Dwg PLOTTED: 8/30/04.

FIGURE 4

SITE MAP AND SAMPLING LOCATIONS MAY 10, 2000 PHOTOGRAPH

MATANUSKA RIVER DEBRIS REMOVAL ASSESSMENT
Palmer, Alaska

oasis ENVIRONMENTAL
807 G STREET, SUITE #250
ANCHORAGE, ALASKA 99501

DATE	CHKD	DRAWN	PROJ. NO
AUGUST 2004	T.M.	C.E.H.	14-053

APPENDIX A

PHOTOGRAPHIC DOCUMENTATION

View overlooking the Matanuska River looking towards the debris disposal area. (7/16/04)

View looking down at the debris disposal area from the hiking trail. Notice new tree cuttings that have been dumped here since the 5/26/04 site assessment. (7/16/04)

DEBRIS REMOVAL PLAN MATANUSKA RIVER DEBRIS AREA PALMER, ALASKA	Photo Page No. 1	Date: August 2004 Project No. 14-053

Photo showing bottom section of railroad car sitting in the Matanuska River. (7/16/04)

Another view looking at the railroad car section that shows how it provides some bank erosion protection from the Matanuska River. (7/16/04)

Additional rail car debris laying in a channel of the Matanuska River. (7/16/04)

Photo looking upstream at auto and rail car debris located below the water level of the Matanuska River. (7/16/04)

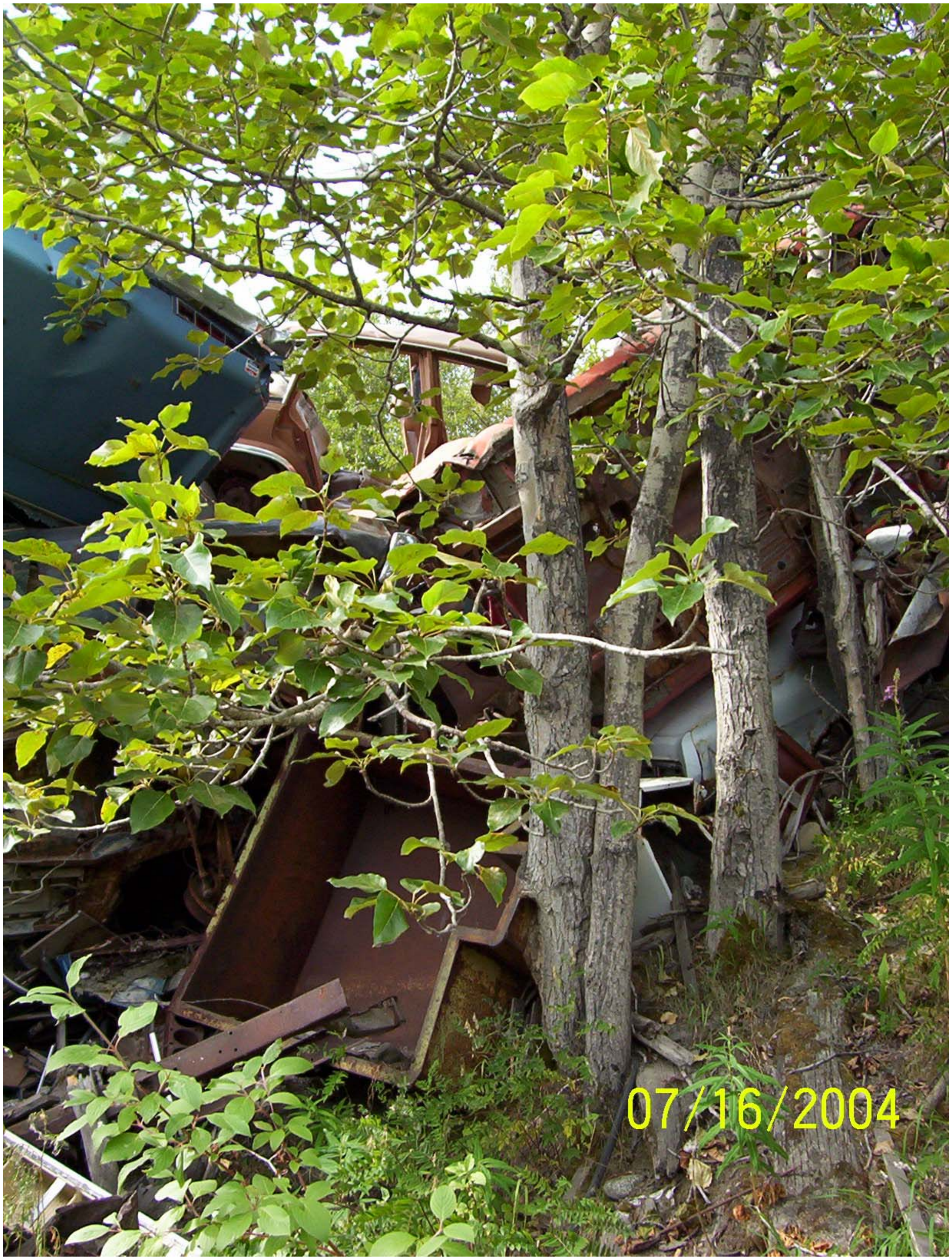
DEBRIS REMOVAL PLAN MATANUSKA RIVER DEBRIS AREA PALMER, ALASKA	Photo Page No. 3	Date: August 2004 Project No. 14-053

Photo looking upstream along the edge of the Matanuska River from the debris disposal area. (7/16/04)

DEBRIS REMOVAL PLAN MATANUSKA RIVER DEBRIS AREA PALMER, ALASKA	Photo Page No. 4	Date: August 2004 Project No. 14-053

Photo showing new graffiti that was not present during the May 26, 2004 site assessment. (7/16/04)

Photo showing rail car debris intermingled with trees and other vegetative growth. (7/16/04)



Car bodies and other debris near northern edge of the main debris pile showing how trees are supporting the debris. Also indicates the relatively recent dumping in comparison to the railroad car debris items. (7/16/04)

DEBRIS REMOVAL PLAN MATANUSKA RIVER DEBRIS AREA PALMER, ALASKA	Photo Page No. 6	Date: August 2004 Project No. 14-053

Photo showing vegetative growth around the frame of an old railroad car. (7/16/04)

Partially buried rail car wheels and axels located near the base of the bluff and next to the Matanuska River. (7/16/04)

Tire tracks in dirt at top of debris disposal area showing evidence of vehicles driving on the hiking trail. (7/16/04)

DEBRIS REMOVAL PLAN MATANUSKA RIVER DEBRIS AREA PALMER, ALASKA	Photo Page No. 8	Date: August 2004 Project No. 14-053

Matanuska River bank stabilization efforts in the Bodenburg Butte area. These large rock finger dikes were constructed in 1992 to prevent further bank erosion. (7/16/04)

Looking downstream at additional rock finger dikes in the Bodenburg Butte area. Notice that some bank erosion has occurred between the two closest dikes. (7/16/04)

Active Matanuska River bank erosion is occurring in the Circle View Estates subdivision just downstream from protective dikes. (7/16/04)

The bank erosion has started to impact the local roadway. Notice the trees that have fallen into the Matanuska River just downstream of the cut bank. (7/16/04)

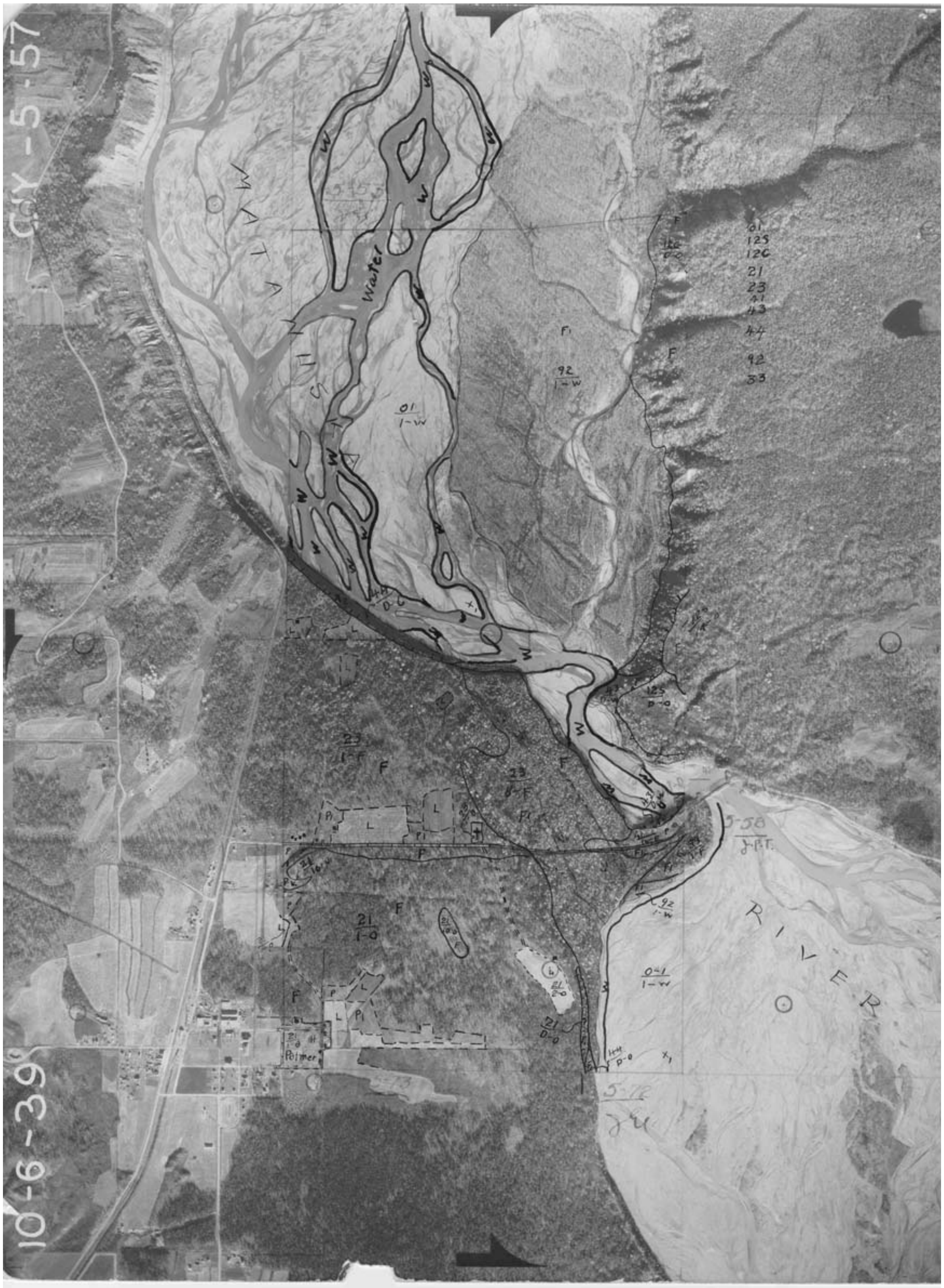
Close up photograph of the bank erosion area. Notice stress cracks along bank edge and could also hear a steady fall of the gravelly bank material falling into the river. (7/16/04)

DEBRIS REMOVAL PLAN MATANUSKA RIVER DEBRIS AREA PALMER, ALASKA	Photo Page No. 11	Date: August 2004 Project No. 14-053

Marker indicating that over 80 feet of the bank has eroded from July 11 though July16. (7/16/04)

Photo showing the braided channel flow present in the Matanuska River. (7/16/04)

DEBRIS REMOVAL PLAN MATANUSKA RIVER DEBRIS AREA PALMER, ALASKA	Photo Page No. 12	Date: August 2004 Project No. 14-053



1939 aerial photograph of the Matanuska River. The debris disposal area is located at the bend in the Palmer to Sutton rail line where it meets up with the Matanuska River.

APPENDIX B

Alaska Department of Natural Resources

July 16, 2004, Site Visit Letter of Memorandum

MEMORANDUM

STATE OF ALASKA

Department of Natural Resources

Div. Mining Land & Water
Alaska Hydrologic Survey

TO:	Kent Patrick-Riley ADEC	DATE:	07/19/2004
		FILE NO:	
THRU:			
		TELEPHONE: FAX:	269-8638 269-8947
FROM:	Mark Inghram & Mary Maurer Hydrologists	SUBJECT:	ARR Mat River Disposal Site

This past Friday, 07/16/2004, personnel from both ADNR, ADEC, the Palmer Soil and Water Conservation District, and Oasis Environmental Inc., made a joint field reconnaissance of a disposal/debris site on the Matanuska River north Eagle Avenue near Palmer. Participating in the field inspection from ADNR were Mark Inghram and Mary Maurer from the Alaska Hydrologic Survey; Chris Nahorney from ADNR South Central Lands Section; from ADEC Kent Patrick-Riley and Laura Eldred; from the Palmer Soil and Water Conservation District Bill Long; and from Oasis Environmental Inc. Tim McDougall.

The issue involved the apparent disposal by the Alaska Railroad (ARR) of railcars, bridges, ties and other debris over the edge of the bluff along the Matanuska River at an undetermined date; and the subsequent use of the disposal site for disposal of old cars, appliances, and other debris. Although unclear, it appears that most of the disposal area is on ARR property. The rail line at the site was abandoned in 1969; the disposal of the ARR equipment likely took place prior to that abandonment. The specific purpose of the site visit on 07/16/2004 was to make a joint assessment of the disposal site to determine the status of the site, and if any remedial action was warranted or needed.

The ARR is reportedly asserting that the original purpose of the disposal site was for erosion control. The haphazard disorganized nature of how the ARR materials are now situated on the bank would strongly suggest that little attempt was made to place the disposed equipment to maximize the erosion reduction potential. Some of the equipment disposed does appear to have tumbled far enough down slope and in such an orientation as to offer some effective protection from active erosion by the Matanuska River. This equipment is below what we would consider the ordinary high water mark, indicating the disposal has slid onto State lands. If the embankment was bare at the time of the disposal some of the disposed equipment located further up the bank may have also aided in establishing slope stability.

At the present time the disposal area embankment is well vegetated and appears stable. The sizes of the largest trees located on the bank are generally consistent with what would be expected with 35 to 40 years of growth. Immediately downstream of the site is a residential subdivision with houses located near what is largely an unvegetated bank. Evidence would suggest that despite a haphazard jumble of railroad equipment that some measure of bank stabilization resulted from the disposal.

Removal of any of the large and heavy railroad equipment would by necessity result in the near destruction of the vegetative cover essential to erosion control. Additional disturbance would result to the top of the bank due to the need to get large heavy equipment on site. The only logical conclusion is that from a bank stability viewpoint, protecting not only the disposal reach, but also the reach adjacent to the residential subdivision immediately downstream, that the railroad equipment now on the bank remains as is. Removal is likely to cause exposure of a potentially easily erodible bank to the sediment moving potential of the Matanuska River.

A second issue is the disposal of a large number of cars, and other items at the site. Most of these cars are concentrated in a smaller area than the areal extent of the railroad disposal. A few of these car bodies have fallen to below the ordinary high water line, placing them on State lands. While unsightly, most cars and debris are not affecting the bank stability. While a thorough examination of each car was not completed, there were no apparent leakages of contaminants. Many of the cars appeared to have neither engines nor batteries remaining. It appears that many of the cars could be removed with little effect to bank stability with much smaller equipment than would be required to remove the railroad debris. The disposition of these car bodies for esthetic, legal or safety issues is an issue beyond our expertise, and should be addressed by ADNR Lands staff, ADEC, and the Matanuska Susitna Borough.

CC: Bill Long, PSWCD
Chris Nahorney, ADNR

APPENDIX C

ESTIMATED COST TO
PERFORM A LIMITED DEBRIS REMOVAL ACTION

APPENDIX C

In this appendix, cost evaluations are presented for removal and disposal of debris from the Matanuska River disposal site. Only one debris removal alternative was evaluated for this site.

Detailed cost evaluations are provided on the pages of this appendix, along with a discussion of each alternative and the assumptions used in estimating the costs.

APPROACH USED FOR DEVELOPMENT OF COSTS

The development of costs for alternatives evaluated for River Terrace was based on best engineering judgement and experience, in a consistent manner that included the following steps:

1. An outline of the basic components of each alternative was assembled. Basic components included capital materials that would be purchased or constructed, services that would be purchased or rented, and labor.
2. Quantities of the basic components required were estimated. These estimates were based on previous experience with implementing remedial projects, vendor information, and best professional judgement.
3. The prices for the basic components were estimated using vendor information and existing pricing data. An accuracy range between +50 to –30 percent can be expected for the costs provided (USEPA, 1998).
4. A **Construction Cost Subtotal** was calculated from the estimated quantities and prices for the basic components of the alternatives.
5. A 10 to 15 percent charge for **Mobilization and Demobilization** was added to the Construction Cost Subtotal. This charge includes planning, expediting, transportation of personnel, per diem, and other mobilization costs not explicitly included in the basic component outline.
6. A variable percent charge for **Construction Contingencies** was applied to the Construction Cost Subtotal. The Construction Contingency is comprised of a scope contingency and a bid contingency. The scope contingency represents project risks associated with an incomplete design. These contingencies represent capital or O&M costs, unforeseeable at the time the feasibility study is prepared, which are likely to become known as the remedial design proceeds. The bid contingency includes variations caused by weather, unexpected site conditions, quantity overruns, modifications, etc. that occur during construction. A 15 percent bid contingency is generally recommended.
7. An **Administrative Charge** of 15 percent was applied to the Construction Cost Subtotal. This charge includes project management and construction management costs. The Administrative Charge also includes other services during construction including bid and contract administration, negotiations, and additional engineering and design during construction. Finally, this charge includes permitting and legal fees that include the cost of obtaining the required permits to implement the alternative (e.g., NPDES permits for discharges and permitting for wetland activity).

8. A 20 to 40 percent charge for **Engineering and Design** was applied to the Construction Cost Subtotal. The percentage was varied between 20 and 40 percent to determine a reasonable cost, based on the level of complexity of the design and engineering services required.
9. For some alternatives a **Site Technology Licensing** fee was applied to the Construction Cost Subtotal. The percentage was based on the Licensee's fee structure.
10. The items above were summed and added to the **Construction Cost Subtotal** to arrive at the **Capital Cost Total**.
11. **Annual Operation and Maintenance (O&M)** costs were developed for each alternative. The O&M components included recurring consumable materials that would be purchased or constructed, services that would be purchased or rented, sampling and analysis labor. Quantities of the required basic components were estimated. The estimate was based on previous experience with implementing remedial projects, vendor information, and best professional judgement.
12. The **Annual O&M Cost Total** provides a total of the annual cost of O&M and does not include a present-worth analysis.
13. Present-worth analysis was applied to each O&M component sum. The present-worth analysis assumes that 7 percent annual interest can be made on money invested today. The duration of time used for present-worth analysis often varies depending on the remedial alternative. A 2-year duration was assumed for all of the remedial alternatives evaluated under this project.
14. The present-worth costs of each O&M component were summed to arrive at an O&M Cost Total (**Present Worth @ 2 Years @ 7%**).
15. The Capital Cost Total was added to the O&M Cost Total (Present Worth @ 2 years @ 7%) to arrive at a **Total Present Worth Cost**.

ALTERNATIVE A
DEBRIS REMOVAL USING A CABLE CRANE

Capital Cost:	$218,356 to $467,906
O&M Costs (Present Worth @ 2 years):	$12,656 to $27,120
Total Present-Worth Cost:	$231,012 to $495,027

Description:

This alternative consists of debris removal from the main debris pile area. The debris removal will exclude all railcar materials that are located along the Matanuska River bank and all the railcar debris outside the main debris disposal area. The quantity of debris for removal is estimated at 100 to 200 tons. The removed debris will be transported to Alaska Metals Recycling in Anchorage. Because only limited debris removal would be performed along the river bank it was also assumed that no bank stabilization efforts would be required.

A site access route would be constructed following the hiking trail off Eagle Avenue in Palmer. Trees along the access route would be removed as necessary to allow heavy equipment site access. A small dozer would be used to clear and level a path for heavy equipment. Selective tree clearing will also need to be performed at the debris disposal area to allow for movement of the crane boom.

Workers will attach debris to the crane for transporting to the top of the bluff. Large pieces of debris (15 feet or greater in length) will be cut into smaller pieces prior to being moved. An excavator will be used to compact the debris, if possible, and load it onto a flat bed trailer. The debris will be transported to Alaska Metals Recycling in Anchorage. The Palmer landfill facility does not accept automobile bodies at the present time.

Silt fencing and other erosion control measures will be installed during the debris removal effort. Revegetation efforts will include hydro-seeding/mulching, fertilization, and installation of a jute mesh or other suitable matting material. The mesh will be held in place with wooden stakes or staples pressed into the underlying soil. Temporary fencing will be installed around the revegetated areas to prevent people and animals from walking across them.

It is estimated that revegetation maintenance will also be required for a period of 2 years, but the actual maintenance period may vary depending on how well the revegetation efforts work.

Assumptions:

System Installation

- A cable crane with a 50 to 60 foot boom will be used to lift the debris up the embankment.
- Debris removal quantities are estimated at 100 to 200 tons. This excludes all railcar debris near the river and outside the main debris disposal area.
- An excavator or crusher will be used to compact the automobile bodies, appliances, empty drums, etc. before transportation. It was assumed that 8 to 10 truck loads would be sufficient to transport all the debris.
- Cleared trees and other nonmetallic debris will be disposed of at the Palmer landfill site.

- A mixture of seed, fertilizer, and mulch such as HydroMat or an equivalent will be sprayed on all disturbed areas to reestablish vegetation.
- All disturbed areas on the embankment will be covered with a jute mesh (Dekowe 700 or similar material) to assist in slope stabilization and revegetation efforts.
- Temporary fencing will be installed around all revegetated areas to prevent people and animals from disturbing them.
- Watering of the revegetation areas would be performed daily for two weeks and then biweekly for two months or until vegetative growth is well established.

System O&M

- Annual maintenance and repair of the revegetated areas would be performed for two years.

Matanuska Debris Removal Assessment Debris Removal using Cable Crane						
Function	Unit	Quantity	Cost Per Unit	Total Cost	Total Cost (- 30%)	Total Cost (+ 50%)
1. Base Construction Estimate						
1.1 Site Access						
1.1.1 Tree Cutting and Hauling	DAY	5	$1,000	$5,000		
1.1.2 Construct Access Route	LS	1	$5,000	$5,000		
1.1.3 Mobilize Equipment and Setup	LS	1	$10,000	$10,000		
Total for Site Access				**$20,000**		
1.2 Debris Removal						
1.2.1 Crane, Operator, and Laborers	HR	75	$400	$30,000		
1.2.2 Excavator/Crusher	HR	75	$200	$15,000		
1.2.3 Laborers	HR	150	$75	$11,250		
1.2.4 Debris Hauling	HR	60	$100	$6,000		
1.2.5 Debris Disposal Fee	LS	1	$5,000	$5,000		
Total for Debris Removal				**$67,250**		
1.3 Bank Stabilization/Revegetation						
1.3.1 Install Stabilization Material	SF	40,000	$1.00	$40,000		
1.3.2 Hydroseeding	SF	60,000	$0.25	$15,000		
1.3.3 Watering	DAY	36	$250.00	$9,000		
1.3.4 Temporary Fencing	LF	800	$20	$16,000		
1.3.5 Installation Labor	HR	100	$60	$6,000		
1.3.6 Restore Access Route	LS	1	$5,000	$5,000		
Total for Construct Remediation Cells				**$91,000**		
Construction Cost Subtotal				**$178,250**	**$124,775**	**$267,375**
2. Mobilization / Demobilization	%	1	15%	$26,738		
3. Construction Contingency	%	1	20%	$35,650		
4. Administrative Charge	%	1	15%	$26,738		
5. Engineering and Design	%	1	25%	$44,563		
Capital Cost Total				**$311,938**	**$218,356**	**$467,906**
Annual O&M Costs						
Maintenance Costs	LS	1	$10,000	$10,000		
				$0		
Annual O&M Cost Total				**$10,000**		
Present Worth Analysis						
O&M Cost for Years 1 - 2 @ 7%				$18,080		
Total O&M Cost (Present Worth - 2 yrs)				**$18,080**	**$12,656**	**$27,120**
Total Present Worth Cost (2 Yrs @ 7%)				**$330,018**	**$231,012**	**$495,027**